electronic image converter, and first and second beam sources for illuminating the object, comprising the steps of:

a) illuminating said object with said first beam source at a first illumination level and substantially simultaneously obtaining a first image of the object with the electronic image converter at a first level of received beam energy;

b) illuminating said object with said second beam source and substantially simultaneously obtaining a second image of said object with said electronic image converter at a second level of received beam energy different from said first level;

c) wherein said steps a) and b) are performed in succession to thereby obtain two consecutive images of the object with the electronic image converter at different levels of received beam energy.

26. The method of claim 25, wherein an optical means for influencing the effective amount of beam energy from at least one of said first and second beam sources is placed in an optical path between said at least one beam source and said object.

27. The method of claim 25, wherein an optical means for influencing the effective amount of beam energy from at least one of said first and second beam sources is placed in an optical path between said object and said electronic image converter.

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electronic image converter, and first and second beam sources for illuminating the object, comprising the steps of:

a) illuminating said object with said first beam source at a first illumination level and substantially simultaneously obtaining a first image of the object with the electronic image converter at a first level of received beam energy;

b) illuminating said object with said second beam source and substantially simultaneously obtaining a second image of said object with said electronic image converter at a second level of received beam energy different from said first level;

c) wherein said steps a) and–b) are performed succession to thereby obtain two consecutive images of the object with the electronic image converter at different levels of received beam energy.

26. The method of claim 25, wherein an optical means for influencing the effective amount of beam energy from at least one of said first and second beam sources is placed in an optical path between said at least one beam source and said object.

27. The method of claim 25, wherein an optical means for influencing the effective amount of beam energy from at least one of said first and second beam sources is placed in an optical path between said object and said electronic image converter.

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28. The method of claim 25, wherein output signals of said electronic image converter are digitized and made available to a computer data processing system separate from said scanner.

29. The method of claim 28, wherein image data from said first and second images is processed by image processing algorithms in said computer data processing system to generate three-dimensional information as to said object.

30. The method of claim 25, wherein said electronic image converter operates at a refresh rate, and wherein said refresh rate is substantially in synchronism with said steps of illumination.

31. The method of claim 30, wherein the operation of said first and second beam sources is controlled by a control unit, said control unit synchronizing the operation of said first and second beam sources and said electronic image converter such that said first and second beam sources illuminate said object at a rate substantially equal to said refresh rate.

32. The method of claim 25, wherein at least one of said first and second beam sources projects a pattern onto said object.

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33. The method of claim 25, wherein at least one of said first and second beam sources comprises a source of high brightness having an illumination time of between 0.001 and 0.01 seconds.

34. The method of claim 33 wherein said source of high brightness comprises a flash lamp.

35. The method of claim 25, wherein said first and second beam sources illuminate said object from different spatial directions.

36. The method of claim 35, wherein said first and second beam sources comprise beam sources emitting radiation in different portions in the electromagnetic spectrum.

37. A method for scanning an object with a scanner having at least two two-dimensional electronic image converters, at least one optical element imaging the object on the electronic image converters, and first and second beam sources for illuminating the object, comprising the steps of:

a) illuminating said object with said first beam source at a first illumination level and substantially simultaneously obtaining a first image of the object with a first electronic image converter at a first level of received beam energy;

b) illuminating said object with said second beam source and substantially simultaneously obtaining a second image of said object with a second electronic

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image converter at a second level of received beam energy different from said first level;

c) wherein said steps a) and–b) are performed in succession to thereby obtain two consecutive images of the object with said electronic image converters at different amounts of received beam energy.

38. The method of claim 37, wherein said first beam source comprises a source of visible spectrum radiation and wherein said second beam source comprises a source of infra-red radiation.

39. The method of claim 37, wherein said first beam source comprises a source of visible spectrum radiation and wherein said second beam source comprises a source of ultraviolet radiation.

40. A scanner for scanning an object and obtaining three-dimensional information about the surface of said object, comprising:

a) at least one two-dimensional electronic image converter;

b) at least one optical element imaging said object on said electronic image converter;

c) a first beam source for illuminating said object and a second beam source for illuminating said object,

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d) wherein said first beam source illuminates said object and substantially simultaneously a first image of the object is obtained by said at least one electronic image converter, said first image obtained from incident radiation at a first level of received beam energy;

e) wherein said second beam source illuminates said object and substantially simultaneously a second image of said object is obtained by said at least one electronic image converter, said second image obtained from incident radiation at a second level of received beam energy different from said first level; and

f) wherein said illumination of said object and the generation of said first and second images are performed in succession such that said electronic image converter thereby obtains two consecutive images of the object at different levels of received beam energy.

41. The scanner of claim 40, wherein said electronic image converter comprises a charge-coupled device array.

42. The scanner of claim 40, wherein said scanner further comprises a prism adapted for directing radiation from said beam sources in the direction of said object, said prism sized and shaped so as to have a portion thereof fit into the oral cavity of a human and enable said portion to be moved relative to anatomical structures within said oral cavity.

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43. The scanner of claim 40, wherein said at least one of said beam sources comprises a flash lamp.

44. The scanner of claim 42, wherein the scanner further comprises a frame housing said first and second beam sources and wherein said prism is rigidly connected to said frame.

45. The scanner of claim 44, wherein said optical element comprises at least one lens element fixed with respect to said frame.

46. The scanner of claim 44, wherein said carrier further comprises at least one optically reflective surface reflecting radiation from said at least one beam source towards said object.

47. The scanner of claim 46, wherein said reflective surface comprises a peripheral internal surface of said carrier.

48. The scanner of claim 46, wherein said reflective surface comprises at least two internal surfaces of said carrier, and wherein radiation from said beam sources undergoes total internal reflection in a path between said beam sources and said object.

49. The scanner of claim 46, wherein said reflective surface further comprises a mirror.

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50. The scanner of claim 44, wherein said carrier is releasable from said frame to thereby permit said carrier to be separately sterilized and/or disinfected from said frame.

51. A method for in-vivo scanning of teeth of a human or animal patient with a scanner to acquire three-dimensional information as to said teeth, said scanner comprising a first beam source and a second beam source, a two-dimensional electronic image converter and a carrier directing radiation from said beam sources towards said teeth, comprising the steps of:

a) inserting a portion of said carrier into the oral cavity of said patient;

b) operating said first beam source at a first illumination intensity so as to illuminate said teeth and substantially simultaneously obtaining a first image of said teeth with said electronic image converter at a first level of received beam energy;

c) operating said second beam source so as to illuminate said teeth at a second illumination intensity and substantially simultaneously obtaining a second image of said teeth with said electronic image converter at a second level of received beam energy different from said first level;

d) projecting a pattern onto said teeth during at least one of said steps b) and c) and subsequently analyzing said first and second images to generate three dimensional information for said teeth.

e) wherein said steps b) and c) are performed in succession to thereby obtain two consecutive images of the object with the electronic image converter at different effective amounts of received beam energy.

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52. The method of claim 51, further comprising the step of moving said portion of said carrier to a new position in said oral cavity and repeating the performance of steps b), c), d) and e).

53. The method of claim 51, wherein said electronic image converter comprises a charge coupled device and operates at a refresh rate, and wherein steps b) and c) are performed in substantial synchronism with said refresh rate.

54. The method of claim 51, wherein at least one of said first and second beam sources comprises a flash lamp.

55. A method for scanning an object with a scanner having at least one two-dimensional electronic image converter, at least one optical element imaging the object on the electronic image converters, and first and second beam sources for illuminating the object, comprising the steps of:

a) illuminating said object with said first beam source with radiation predominantly in a first portion of the electromagnetic spectrum and substantially simultaneously obtaining a first image of the object with said at least one electronic image converter;

b) illuminating said object with said second beam source with radiation predominantly in a second portion of the electromagnetic spectrum different from

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said first portion and substantially simultaneously obtaining a second image of said object with said at least one electronic image converter;

c) wherein said steps a) and–b) are performed in succession to thereby obtain two consecutive images of the object with said at least one electronic image converter at two different portions of the electromagnetic spectrum.

56. The method of claim 55, wherein said first portion of the electro-magnetic spectrum comprises the visible spectrum and wherein the second portion of the electromagnetic spectrum comprises either the ultraviolet or infrared portions of the electromagnetic spectrum.

57. The method of claim 55, wherein at least one of said first and second beam sources projects a pattern onto said object.

58. The method of claim 55, wherein said first and second beam sources illuminate said object from different spatial directions.

REMARKS

Section 112 Rejection

In the first office action, the Examiner rejected the originally filed claims as being indefinite for failing to particularly point out and distinctly claim the invention.

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